3.2 Medical Requirements Overview

TABLE 3.2: MEDICAL REQUIREMENTS OVERVIEW

MRID# and Title:	MR008L Toxicological Assessment Using Compound Specific Analyzer-Combustion Products (CSA-CP)
Sponsor:	Medical Operations
Discipline:	Environmental Health
Category:	Medical Requirements
References:	ISS Medical Operations Requirements Document SSP 50260
Purpose/Objectives:	To provide monitoring of the ISS environment if a pyrolysis event is suspected or during decontamination of the atmosphere once an event has taken place. It is also present to guide donning and doffing of PPE. The Compound Specific Analyzer-Combustion Products (CSA-CP) monitor provides real-time readings following a combustion event and subsequent clean-up efforts. This information may be used to guide donning and doffing of PPE.
Measurement Parameters:	Detection and concentration of carbon monoxide, hydrogen chloride, hydrogen cyanide and oxygen.
Deliverables:	Real-time assessment of crew exposure to specific noxious combustion by-products.
Flight Duration:	≥30 days
Number of Flights:	Every ISS Expedition
Number and Type of Crewmembers Required:	1 crewmember to act as operator
Other Flight Characteristics:	N/A

3.3 Preflight Training

TABLE 3.3: PREFLIGHT TRAINING

<table>
<tr><td rowspan="3">Preflight Training Activity
Description:</td><td colspan="5">Training/Familiarization will be covered under the following Environmental Health System (EHS) documents and lessons:
EHS Toxicological Operations</td></tr>
<tr><td rowspan="2">Schedule:</td><td>Duration:</td><td>Schedule:</td><td>Flexibility:</td><td colspan="2">Personnel Required:</td></tr>
<tr><td>EHS Toxicological Operations:
Experienced CM 30 min
Inexperienced CM 85 min</td><td>L-18 months</td><td>N/A</td><td colspan="2">Crewmembers/Instructors</td></tr>
<tr><td rowspan="2">Ground Support Requirements Hardware/Software</td><td>Preflight Hardware:</td><td colspan="2">Preflight Software:</td><td colspan="2">Test Location:</td></tr>
<tr><td>CSA-CP
CSA Cal Adapter
Portable Gas Delivery System
CSA-CP Sampling Pump
CSA-CP Zero Filter
CSA-CP Sampling Pump Filters
CSA-CP Data Cable
CSA-CP Sample Probe
CSA-CP/CDM Battery Packs
Station Support Computer (SSC)</td><td colspan="2">CSA-CP Software on SSC</td><td colspan="2">U.S</td></tr>
<tr><td rowspan="4">Training Facilities</td><td>Minimum Room Dimensions:</td><td>Number of Electrical Outlets:</td><td>Temperature Requirements:</td><td colspan="2">Special Lighting:</td></tr>
<tr><td>29' x 14'</td><td>1 (One)</td><td>Ambient</td><td colspan="2">N/A</td></tr>
<tr><td>Hot or Cold Running Water:</td><td>Privacy Requirements:</td><td colspan="3">Other:</td></tr>
<tr><td>N/A</td><td>N/A</td><td colspan="3">1 Table & 6-8 chairs</td></tr>
<tr><td>Constraints/Special Requirements:</td><td colspan="5">None</td></tr>
<tr><td>Launch Delay Requirements:</td><td colspan="5">Refresher training will be available upon crewmember request.</td></tr>
<tr><td>Notes:</td><td colspan="5">Experienced crewmembers (CM) – those CMs who have had previous EHS Toxicology Operations Training.
Inexperienced CMs – those CMs who have never had EHS Toxicology Operations Training.EHS Toxicology Operations includes training for GSC, FMK, CSA-CP, Portable Oxygen Monitor, CDMK, Portable Gas Delivery System, and Air Quality Monitor (AQM).</td></tr>
</table>

3.4 Preflight Activities

TABLE 3.4: PREFLIGHT ACTIVITIES –Launch Delay Requirements

Preflight Activity	No Preflight Activity
Launch Delay Requirements:	For launch delay of ≥30 days (scrub turnaround), the hardware owners and/or Toxicology may choose to refurbish and/or recalibrate the CSA-CPs
Notes:	None
Data Delivery	N/A

3.5 Inflight Activities

TABLE 3.5.1: In-Flight Activities

Table 3.5.1a CSA-CP Nominal Ops

In-Flight Activity	**Description:**	CSA-CP Nominal Ops: During nominal operations the four CSA-CP monitors remain powered down; two deployed in Node 1 and two deployed in the Russian Service Module (SM). All crewmembers will know exactly where the units are located in case a pyrolysis event (i.e., fire) is suspect or confirmed.		
		Duration	Schedule	Personnel Required
	Schedule:	5 min - unstow 5 min – activate 5 min restow (if necessary)	If a pyrolysis event is suspect or confirmed:	1 Crewmember Unattended during unpowered deployment
Procedures:		Procedures can be found in the Systems Operations Data File (SODF) Med Ops book: CSA-CP Operations for CSA-CP monitoring		
Constraints / Special Requirements:		CSA-CP deployed locations should be readily accessible in case a pyrolysis event is suspected or confirmed		
Photo/TV Requirements:		None.		
Cold Stowage Requirements:		N/A		
Mission Extension Requirements:		The CSA-CP monitors must be resupplied based on the calibration interval of the sensors.		
Notes:		Location of CSA-CP monitors: Two deployed in Node 1 and two deployed in the Russian Service Module (SM).		
Data Delivery		CSA-CP data may be verbally communicated to MCC or recorded and downloaded from the CSA-CP and downlinked to ground. Air quality issues will be worked immediately by the Toxicology Section. If warranted, contingency reporting will be included in the overall air quality assessment report provided by the Toxicology Section.		

Table 3.5.1: In-Flight Activities (cont'd)

Table 3.5.1b CSA-CP Activation & Checkout

In-Flight Activity	**Description:**	CSA-CP Activation & Checkout: • Deploy 4 newly resupplied CSA-CP monitors after the battery packs are replaced, the date/time/data logger on each monitor has been reset with the laptop, and the CP sensors have been zero calibrated. • Periodic sensor readings are taken to monitor biased sensor levels until they have reached nominal levels.		
	Schedule:	Duration	Schedule	Personnel Required
		70 min. (total) Part I: 50 min Part II: 20 min	Once every resupply (approximately every 9 months). Data measurements 6-8 days following resupply may be needed to monitor off-gassing and sensor settling of new units.	1 CM
Procedures:		Procedures can be found in the Systems Operations Data File (SODF) Med Ops book: CSA-CP Activation and Checkout.		
Constraints / Special Requirements:		None		
Photo/TV Requirements:		None		
Cold Stowage Requirements:		N/A		
Notes:		The 4 CSA-CP monitors being replaced onboard the ISS will be returned to the JSC Toxicologist for postflight evaluation.		
Data Delivery		Data from ACO, can be reported to MCC-H, or .xml data can be retrieved from the procedure.		

Table 3.5.1c CSA-CP Sampling Pump Battery Changeout - As Needed

In-Flight Activity	**Description:**	CSA-CP Sampling Pump Battery Changeout: Replace the battery pack within the Sampling Pump		
	Schedule:	Duration	Schedule	Personnel Required
		20 min total crew time: 10 min. unstow/stow 10 min. changeout	As needed, when audible beep from pump sounds every 30 seconds.	1 CM
Procedures:		Procedures can be found in the Systems Operations Data File (SODF) Med Ops book: CSA-CP Sampling Pump Battery Changeout		
Constraints / Special Requirements:		Notify MCC-H when the battery changeout is completed.		
Photo/TV Requirements:		None		
Cold Stowage Requirements:		N/A		
Notes:		None		
Data Delivery		N/A		

Table 3.5.1: In-Flight Activities (cont'd)

Table 3.5.1d CSA-CP Sampling Pump Filter Changeout – As Needed

In-Flight Activity	**Description:**	CSA-CP Sampling Pump Filter Changeout: Replace the filter on the Sampling Pump		
	Schedule:	Duration	Schedule	Personnel Required
		15 min total crew time: 10 min. unstow/stow 5 min. changeout	As needed, when pump goes into low flow alarm mode	1 CM
Procedures:		Procedures can be found in the Systems Operations Data File (SODF) Med Ops book: CSA-CP Sampling Pump Filter Changeout		
Constraints / Special Requirements:		None		
Photo/TV Requirements:		None		
Cold Stowage Requirements:		N/A		
Notes:		None		
Data Delivery		N/A		

Table 3.5.1e CSA-CP Extended Routine Maintenance – Every 60 Days

In-Flight Activity	**Description:**	CSA-CP Extended Routine Maintenance: Battery Change out, zero-calibrated and values are compared in all units.		
	Schedule:	Duration	Schedule	Personnel Required
		45 min total crew time: 10 min. unstow/stow, 35 min. battery change out, zero calibrated and compare 4 units.	Every 60 Days	1 CM
Procedures:		Procedures can be found in the Systems Operations Data File (SODF) Med Ops book: CSA-CP Extended Routine Maintenance		
Constraints / Special Requirements:		None		
Photo/TV Requirements:		None		
Cold Stowage Requirements:		N/A		
Notes:		None		
Data Delivery		Data from Extended Routine Maintenance can be reported to MCC-H, or .xml data can be retrieved from the procedure.		

Table 3.5.1: In-Flight Activities (cont'd)

Table 3.5.1f CSA-CP Data Download – Contingency

In-Flight Activity	**Description:**	CSA-CP Data download: Data stored in the datalogger is downloaded to the SSC		
	Schedule:	Duration	Schedule	Personnel Required
		30 min	Contingency Only	1 Operator
Procedures:		Procedures can be found in the Systems Operations Data File (SODF) Med Ops book: CSA-CP Data Download		
Constraints / Special Requirements:		None		
Photo/TV Requirements:		None		
Cold Stowage Requirements:		N/A		
Notes:		None		
Data Delivery		CSA-CP data will be downlinked from the SSC to the Ground for analysis.		

Table 3.5.1g CSA-CP Data Logger Activation/Deactivation - Contingency

In-Flight Activity	**Description:**	CSA-CP Data Logger Activation/Deactivation: Turns the data logger on or off.		
	Schedule:	Duration	Schedule	Personnel Required
		5 min	Contingency Only	1 CM
Procedures:		Procedures can be found in the Systems Operations Data File (SODF) Med Ops book: CSA-CP Data Logger Activation/Deactivation		
Constraints / Special Requirements:		Notify MCC-H in the event of a contingency If contingency, CSA-CP download should occur immediately after this activity.		
Photo/TV Requirements:		None		
Cold Stowage Requirements:		N/A		
Notes:		Data are downloaded to MCC-H in contingency situations.		
Data Delivery		Evaluation of CSA-CP data following a contingency incident, e.g. fire, will be worked real-time by the Toxicology Section. A preliminary assessment will be provided as soon as possible, typically within an hour, after receipt of all pertinent information. CSA-CP data is saved on the Toxicology server which is backed-up daily.		

Table 3.5.1: In-Flight Activities (cont'd)

Table 3.5.1h Contingency Sampling using CSA-CP

In-Flight Activity	**Description:**	Contingency Sampling using CSA-CP • Unit mated with sampling pump and probe • Activate data logger		
	Schedule:	Duration	Schedule	Personnel Required
		As Needed: 10 min unstow, assemble, activate 3 min/sample (as needed during sampling time duration) 10 min deactivate, disassemble, stow	Contingency only	1 CM
Procedures:		Procedures can be found in the Systems Operations Data File (SODF) Med Ops book: CSA-CP Active Sampling with Probe and Data Logging		
Constraints / Special Requirements:		Sampling may be required when difficulty in breathing, irritation of airways, headache, confusion and at discretion of crewmember or Flight Surgeon		
Photo/TV Requirements:		Photo documentation is required during contingency situations.		
Cold Stowage Requirements:		N/A		
Mission Extension Requirements:		None		
Notes:		Data are downloaded to MCC-H in contingency situations.		
Data Delivery		Evaluation of CSA-CP data following a contingency incident, e.g. fire, will be worked real-time by the Toxicology Section. A preliminary assessment will be provided as soon as possible, typically within an hour, after receipt of all pertinent information. CSA-CP data is saved on the Toxicology server which is backed-up daily.		

Table 3.5.1i CSA-CP Alarm/Autolog Setpoint Change – Contingency

In-Flight Activity	**Description:**	CSA-CP Alarm/Autolog Setpoint Change: Sets the instantaneous alarm thresholds (setpoints)		
	Schedule:	Duration	Schedule	Personnel Required
		20 min	Contingency Only	1 CM
Procedures:		Procedures can be found in the Systems Operations Data File (SODF) Med Ops book: CSA-CP Alarm/Autolog Setpoint Change		
Constraints / Special Requirements:		Notify MCC-H prior to changing any alarm/autolog setpoint.		
Photo/TV Requirements:		None		
Cold Stowage Requirements:		N/A		
Notes:		N/A		
Data Delivery		N/A		

Table 3.5.1: In-Flight Activities (cont'd)

Table 3.5.1j Post Fire Analysis using CSA-CP – Contingency

In-Flight Activity	**Description:**	Post Fire Analysis using CSA-CP: • Monitor air quality using at least two CSA-CP units • Download Data to SSC		
	Schedule:	Duration	Schedule	Personnel Required
		As needed: 20 min. unstow, activate, and deploy units 3 min/sample (as needed sampling time duration) 5 min. deactivate and stow units 30 min. data download to SSC	Contingency only	1 CM
Procedures:		Procedures can be found in the Systems Operations Data File (SODF) Med Ops book: Post Fire Air Analysis		
Constraints / Special Requirements:		Sampling may be required when difficulty in breathing, irritation of airways, headache, confusion and at discretion of crewmember or Flight Surgeon. For CO > 50ppm an additional measurement is required using the CO Draeger Tube.		
Photo/TV Requirements:		Photo(s) showing deployment location(s) during contingency operations is (are) required.		
Cold Stowage Requirements:		N/A		
Mission Extension Requirements:		None		
Notes:		Data are downloaded to MCC-H in contingency situations.		
Data Delivery		Evaluation of CSA-CP data following a contingency incident, e.g. fire, will be worked real-time by the Toxicology Section. A preliminary assessment will be provided as soon as possible, typically within an hour, after receipt of all pertinent information. CSA-CP data is saved on the Toxicology server which is backed-up daily.		

TABLE 3.5.1k CSA-CP BATTERY PACK CHANGEOUT - Contingency

In-flight Activity	**Description:**	CSA-CP/CDM Battery Pack Changeout: The battery pack is replaced in the unit when required (aside from nominal maintenance)		
	Schedule:	**Duration:**	**Schedule:**	**Personnel Required:**
		10 min per CSA-CP monitor	As needed	1 CM
Procedures:		Procedures can be found in the Systems Operations Data file (SODF) Med Ops book: CSA-CP – Battery Changeout		
Constraints/Special Requirements:		Should only be performed if a CSA-CP unit is indicating Low Battery status.		
Photo/TV Requirements		None		
Cold Storage Requirements		N/A		
Notes:		None		
Data Delivery		N/A		

TABLE 3.5.2: IN-FLIGHT HARDWARE

Hardware/Software Name
CSA-CP Monitor Assembly
CSA Cal Adapter
Portable Gas Delivery System
CSA-CP Sampling Pump
CSA-CP Sampling Pump Filters
CSA-CP Zero Filter
CSA-CP Sample Probe
CSA-CP/CDM Battery Packs
CSA-CP Data Cable
Station Support Computer (SSC)
CSA-CP Software

3.6 Postflight Activities – No Postflight Activities

3.7 Summary Schedule

TABLE 3.7: SUMMARY SCHEDULE

ACTIVITY	DURATION	SCHEDULE	PERSONNEL REQUIRED	CONSTRAINTS
Preflight Training				
EHS Toxicology Operations: Experienced CM Inexperienced CM	30 min 85 min	L-12 months	Crewmembers/ Instructors	None
Preflight: N/A				
In-Flight				
CSA-CP Nominal Ops	5 min - unstow 5 min – activate 5 min restow (if necessary)	If a pyrolysis event is suspect or confirmed	1 CM Unattended during nominal operations	The CSA-CP monitors are deployed (unpowered) as follows: • Two in Node 1 • Two in the Russian Service Module (SM)
CSA-CP Activation & Checkout	70 min. Total Part I: 50 min Part II: 20 min	Once every resupply (approximately every 9 months). Data measurements 6-8 days following resupply may be needed to monitor off-gassing of new units.	1 CM	
CSA-CP Sampling Pump Battery Changeout	20 min	As needed	1 CM	Notify MCC-H when the battery changeout is completed.
CSA-CP Sampling Pump Filter Changeout	15 min	As needed	1 CM	None
CSA-CP Extended Routine Maintenance	45 min	Every 60 Days	1 CM	None
CSA-CP Data Download - Contingency	30 min	Contingency only	1 CM	None
CSA-CP Data Logger Activation/Deactivation - Contingency	5 min	Contingency only	1 CM	Notify MCC-H in the event of a contingency If contingency, CSA-CP download should occur immediately after this activity

Contingency Sampling using CSA-CP	10 min – Unstow, Assemble, Activate 3 min/sample 10 min – Deactivate, Disassemble, Stow	Contingency only	1 CM	Photo in contingency situation Sampling may be required when there is difficulty in breathing, irritation of airways, headache, confusion and at discretion of crewmember or Flight Surgeon.
CSA-CP Alarm/Autolog setpoint Change - Contingency	20 min	Contingency only	1 CM	Notify MCC-H prior to changing any alarm/autolog setpoint
Post fire Analysis using CSA-CP - Contingency	25 min – Unstow/Stow 3 min/sample 30 min data download	Contingency only	1 CM	Photo in contingency situation Sampling may be required when difficulty in breathing, irritation of airways, headache, confusion and at discretion of crewmember or Flight Surgeon. For CO> 50 ppm, an additional measurement is required using the CO Draeger Tube.
Postflight: N/A				
Postflight Debrief:				
Crew Debrief	15 min.	~R+30 days	Crewmembers & Toxicology Team	Included as part of the overall Med Ops debrief.